# Project 1 b)

We have a linear set of equations The matrix A can be rewritten as

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & \cdots & \cdots & \cdots\\a\_2 & b\_2 & c\_2 & 0 & &\\0 & a\_3 &b\_3 & c\_3 & 0 &\\\vdots&\vdots & \ddots& \ddots&\ddots &\vdots\\0 & & & a\_{n-1} & b\_{n-1} & c\_{n-1}\\0 & & & & a\_{n} & b\_n\end{matrix}\right]$

where are one-dimensional arrays with lenght .

Then we can write the linear set of equations as

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & \cdots & \cdots & \cdots\\a\_2 & b\_2 & c\_2 & 0 & &\\0 & a\_3 &b\_3 & c\_3 & 0 &\\\vdots&\vdots & \ddots& \ddots&\ddots &\vdots\\0 & & & a\_{n-1} & b\_{n-1} & c\_{n-1}\\0 & & & & a\_n & b\_n\end{matrix}\right] \left[\begin{matrix}u\_1\\u\_2\\ \cdots\\\cdots\\\cdots\\u\_n\end{matrix}\right] = \left[\begin{matrix}f\_1\\f\_2\\ \cdots\\\cdots\\\cdots\\f\_n\end{matrix}\right]$

In the case you will get

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & 0 \\a\_2 & b\_2 & c\_2 & 0 &\\0 & a\_3 &b\_3 & c\_3 &\\ 0 & 0 & a\_4 & b\_4\end{matrix}\right]\left [\begin{matrix}u\_1\\u\_2\\u\_3\\u\_4\end{matrix}\right] = \left[\begin{matrix}f\_1\\f\_2\\f\_3\\f\_4\end{matrix}\right]$

If you apply Gaussian elimination by you will get

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & 0 \\0 & b\_2-\frac{a\_2c\_1}{b\_1} & c\_2 & 0 &\\0 & a\_3 &b\_3 & c\_3 &\\ 0 & 0 & a\_4 & b\_4\end{matrix}\right]$

And on the right hand side

$\left[\begin{matrix}f\_1\\f\_2-\frac{a\_2f\_1}{b\_1}\\f\_3\\f\_4\end{matrix}\right]$

Then we put .

This gives

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & 0 \\0 & \tilde b\_2 & c\_2 & 0 &\\0 & a\_3 &b\_3 & c\_3 &\\ 0 & 0 & a\_4 & b\_4\end{matrix}\right]$

and on the right hand side

$\left[\begin{matrix}f\_1\\\tilde f\_2\\f\_3\\f\_4\end{matrix}\right]$

If we do the same for row III and IV we will get

$\mathbf{A}=\left[\begin{matrix}b\_1 & c\_1 & 0 & 0 \\0 & \tilde b\_2 & c\_2 & 0 &\\0 & 0 & \tilde b\_3 & c\_3 &\\ 0 & 0 & 0 & \tilde b\_4\end{matrix}\right]$

and

$\left[\begin{matrix}f\_1\\\tilde f\_2\\\tilde f\_3\\f\_4\end{matrix}\right]$

From this you can notice a pattern which can be generalized as